UNITED NATIONS CONFERENCE
ON THE APPLICATION OF SCIENCE AND TECHNOLOGY
FOR THE BENEFIT OF THE LESS DEVELOPED AREAS

E/CONF.39/D/156
SUMMARY
16 Nov.1962
ENGLISH
ORIGINAL : FRENCH

SUMMARY

Agenda Item : D.13

France

PRESTRESSED CONCRETE IN DEVELOPMENT AREAS

By Georges WORONTZOFF,
Engineer, Société Technique
pour l'utilisation de la précontrainte

Papers have been contributed to the United Nations Conference on the Application of Science and Technology for the Benefit of the Less Developed Areas as working papers for that Conference. They are published as presented by the contributors, and the contents and the views expressed are those of the contributors. (See notes overleaf.)

NOTES

1. Papers selected for inclusion in General Sessions will be available at the Conference in the following official languages of the United Nations: English, French, Russian and Spanish.

2. Papers selected for inclusion in Specialized Sessions will be available at the Conference in only one of the above official languages.

3. Summaries of all papers, as submitted by contributors, will be available at the Conference in the following official languages of the United Nations: English, French, Russian and Spanish.

4. Papers and summaries will not be available for general distribution in advance of the Conference. They will be published in advance in limited quantities only for the use of delegations of participating governments and of other authorized participants. Post-Conference publication and general distribution of the Conference Proceedings will follow United Nations practices as laid down by the United Nations Publications Board.

PRESTRESSED CONCRETE IN DEVELOPMENT AREAS

By

GEORGES WORONTZOFF, ENGINEER, SOCIETE TECHNIQUE POUR L'UTILISATION DE LA PRECONTRAINTE.

1. Brief definition of prestressed concrete

Unlike conventional reinforced concrete with its mild or semi-hard steel cast in, prestressed concrete uses hard steels of high tensile strength, stressed close to this level. There are two main methods of prestressing:

Pre-tensioning, using wires bonded to the concrete, in which the wires are stretched before the concrete is poured. This process is used for mass-producing floor joists, columns, piles, irrigation channel units, etc.

Post-tensioning, applied after the hardening of the concrete. This method, requiring no fixed plant, is used in structures poured in situ, or prefabricated on the site.

2. History

The birth and development of prestressed concrete are based on the work of Eugène Freyssinet (1879 - 1962). The first work dates from 1933 - 35 (France, Algeria, Germany). The beginning of the current upsurge of development was in the early post-war years. Prestressed concrete is now universally used, and most countries have published rules for its use. Hard steels are being produced, and construction methods constantly being improved.

3. Engineering and cost advantages of prestressed concrete

3.0 Its precompression eliminates the cracks from ordinary prestressed concrete, which is therefore a homogeneous material. This absence of cracking makes it waterproof, which is particularly important for structures in water or at the seaside.

3.1 The prestressing force submits the materials to stresses higher than those imposed by loading. It is therefore a preliminary test of the entire structure, which no other building material enjoys.

3.2 The saving in weight of steel in relation to ordinary reinforced concrete, in bridges for example, is about 70%, resulting in a cost reduction of 26% which enables considerable savings to be made. There is also a reduction in volume of concrete of 10 to 20%, as compared with reinforced concrete. These savings in materials lead in turn to savings in transport costs and in foreign exchange.

3.3 Prestressed concrete structures are lighter and of larger span than reinforced concrete ones, for beams of the same height.

3.4 Prestressed concrete is easily precast.

4. Analysis of prestressed concrete achievements in development countries

4.0 The development of prestressed concrete in a country does not always correspond to the general development of the country from other aspects. Thus in India, prestressed concrete has been developed with benefit to the economy of the country as a whole.

4.1 Prestressing suits bridge construction particularly, because the quantities of steel used are large. It is in bridge building therefore, that prestressing develops most quickly. In India, 460 spans of road bridges have been built, as well as many railway bridges, making large savings in cost and foreign exchange. Modern methods (prefabrication of beams and their launching into position) have been shown to be economic even in this country of abundant cheap labour. India now has technically-trained teams of her own people.

The saving in materials has been particularly valuable for bridges on the Ivory Coast and in Madagascar (Malgasy).

The large bridges built at Abidjan, Douala, Goya-Melanville, and Bamako, have shown that local labour can be used for prefabrication. Bridge building in undeveloped countries has been satisfactory, and will continue to develop.

4.2 Prestressed concrete hydraulic structures have the advantage of long life because of the absence of cracking. Many ports have such structures, including the flooring of open or closed jetties, caissons and piers.

4.3 The construction of a factory for pre-tensioned precast concrete presupposes an adequate market and transport facilities. Development countries are thus not favourable sites for pre-tensioning, unless development plans ensure a market (urban development, construction of electric power lines; irrigation etc.)

4.4 The application of prestressed concrete to irrigation lies in the production of precast units for flumes and high-pressure pipes.

5. Future possibilities

Prestressed concrete has not yet acquired the volume of work that could be justified by its advantages. The number of buildings using it is still small in development countries. Its application is helpful in industrial buildings with large spans and heavy loads, in thin shell roofs, or floor beams. Its use for reservoirs is not common, despite its advantages. To promote the rational development of prestressed concrete in development countries, the following is necessary:

adoption of international regulations for design and construction;

support standardisation to the maximum;

full use of equipment so as to amortize it quickly;

Technical help can include:

investigation by specialist organisations into the application of prestressing to specific programmes, to decide for or against its use;

training of specialist engineers either by courses in countries advanced in prestressed concrete techniques, or by specialists brought to the country itself.

S - 1126 E - Nov.1962 - 1,600